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WEBINAR



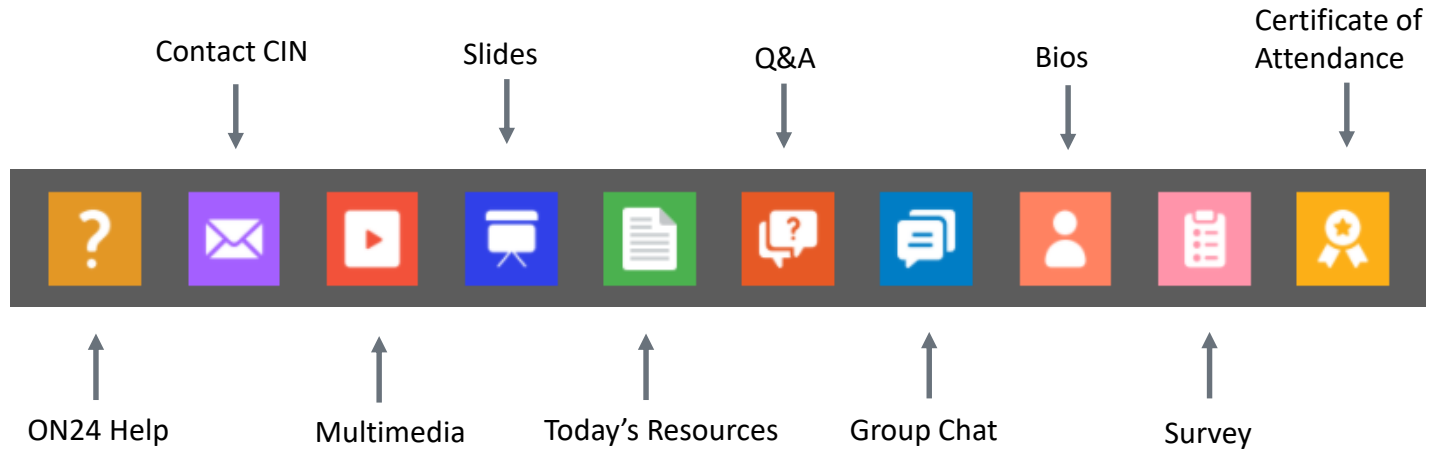
CompTIA Network+ N10-009 TTT Session 4:

Title

July 2, 2024

CompTIA®

 @TeachCompTIA #NetworkPlusTTT



Network+ Team



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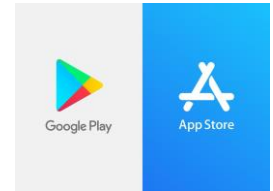
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Join us for the morning session from 9:00 a.m. to 12:00 p.m. or
the afternoon session from 1:00 p.m. to 4:00 p.m.

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Hyatt Regency Atlanta

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Network+ N10-009 TTT Session Outline

Date	Topic
✓ 06/20/2024	Introduction and Network Topologies
✓ 06/25/2024	Cabling and Physical Installations
✓ 06/27/2024	Configuring Interfaces and Switches
✓ 07/02/2024	Configuring Network Addressing
07/09/2024	Configuring Routing and Advanced Switching
07/11/2024	Network Security
07/16/2024	Network Security (Continued)
07/18/2024	Wireless Networking
07/23/2024	Troubleshooting and Management
07/25/2024	Emerging Technologies and Trends

CONFIGURING NETWORK ADDRESSING



Learning Objectives



Explain IPv4 addressing schemes.



Explain IPv4 forwarding.



Configure IP networks and subnets.



Use appropriate tools to test a host's IP configuration.



Explain IPv6 addressing schemes.



Troubleshoot IP networks and hosts.

INTERNET PROTOCOL BASICS



Think About It

What is the purpose of a package mailing label?

What information is important to the delivery company?

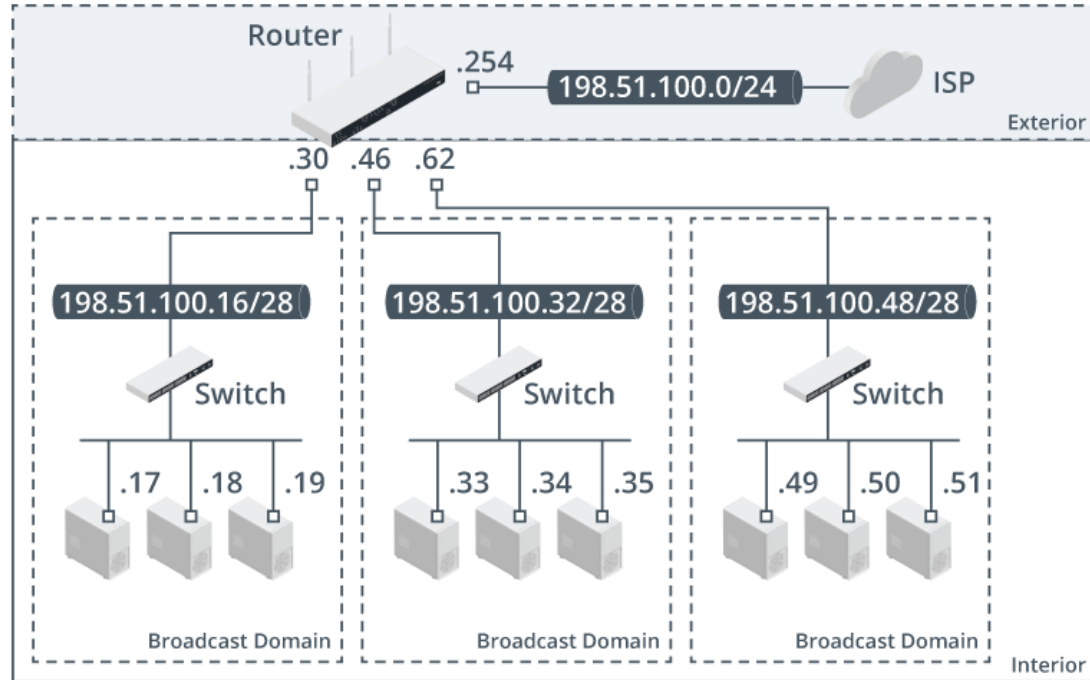


IPv4 Datagram Header

0	4	8	16	31
Version	Header Length	DiffServ	Total Length	
Identification			Flags	Fragment Offset
Time to Live (TTL)	Protocol		Checksum	
Source Address				
Destination Address				
Options				
Data				

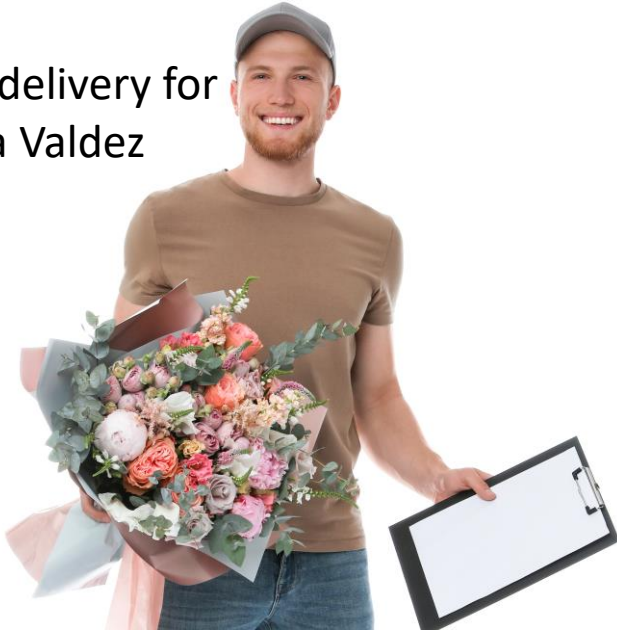


Addressing and Forwarding



Address Resolution Protocol (ARP)

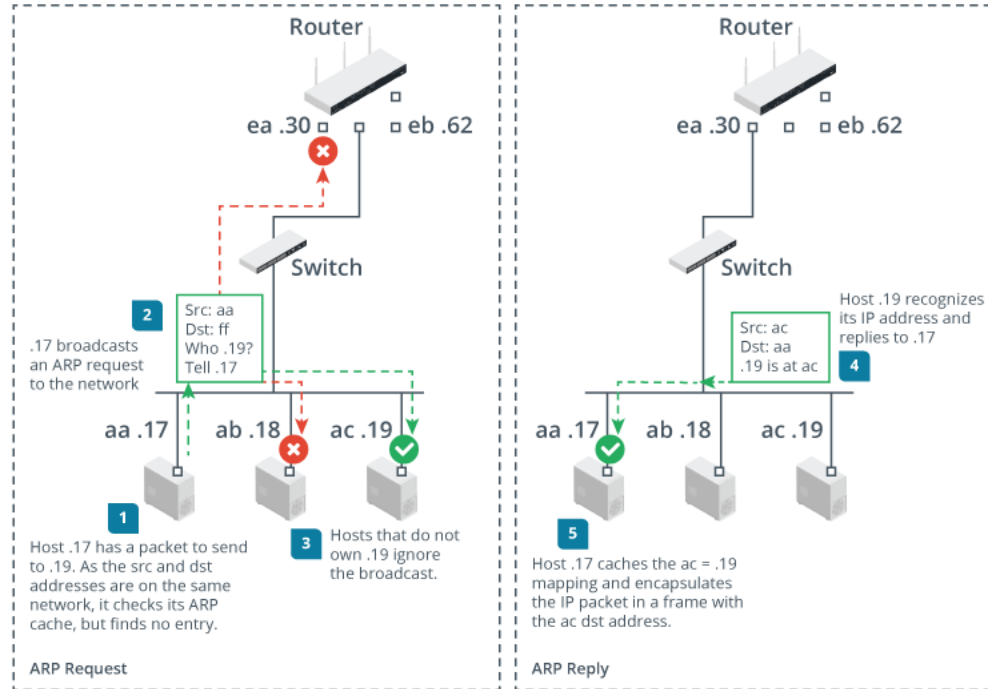
I have a delivery for
a Juanita Valdez



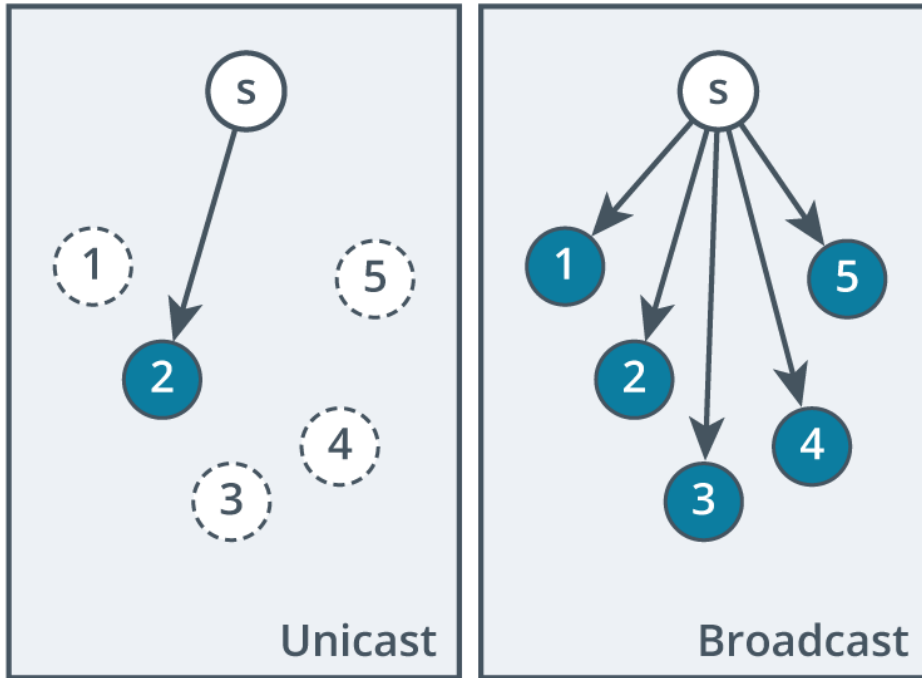
Let me find
her for you!



Access Subnet vs. Remote Using ARP



Unicast and Broadcast Addressing



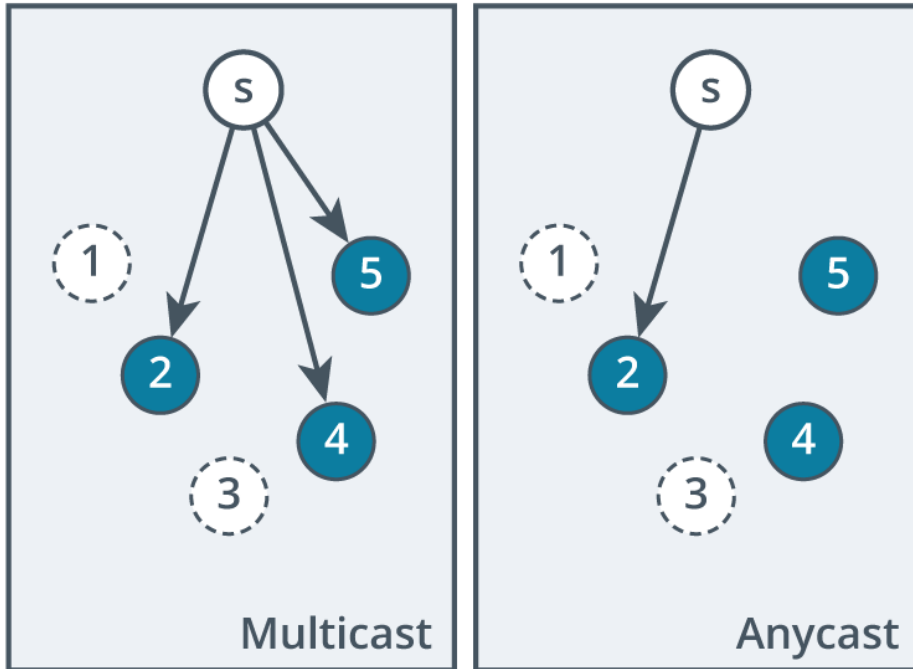
Unicast

- Addressed only to the destination IP
- Sends only to the destination

Broadcast

- Addressed to the last IP address in a network or subnet
- Sends to all hosts on a network or subnet

Multicast and Anycast Addressing



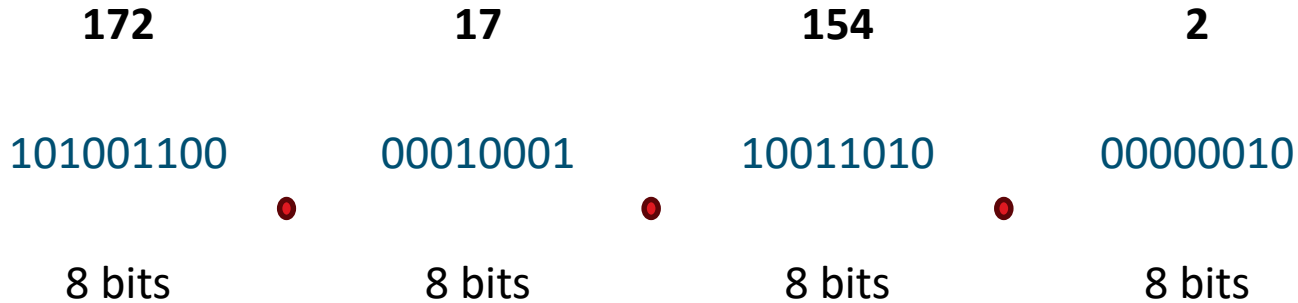
Multicast

- Addressed to a specific group of host IP addresses
- Sends to all hosts on a network or subnet

Anycast

- Addressed to any one device out of a group of devices, typically the closest one
- Used for load balancing and redundancy

IPv4 Addressing



IPv4 addresses are decimal representations of four sets of binary octets.
Each octet is 8 bits, making all IPv4 addresses 32 bits.

Activity: Binary Conversion

Convert 11000011 into standard form:

0	1	1	0	0	0	0	1
128	64	32	16	8	4	2	1

Answer: $64 + 32 + 1 = 97$

IP Address Formatting

Network ID

Like an apartment
building number

Common to all hosts on
the same IP network

Host ID

Like an apartment
number within a
building

Identifies a host within
an IP network

Subnet Masks

Subnet Masks

- Identifies the network portion of an IP address
- If network ID matches the local network, transmission is sent directly to host – otherwise it is forwarded
- Help devices determine which network or subnet it belongs

Determining Subnet Mask

Example:

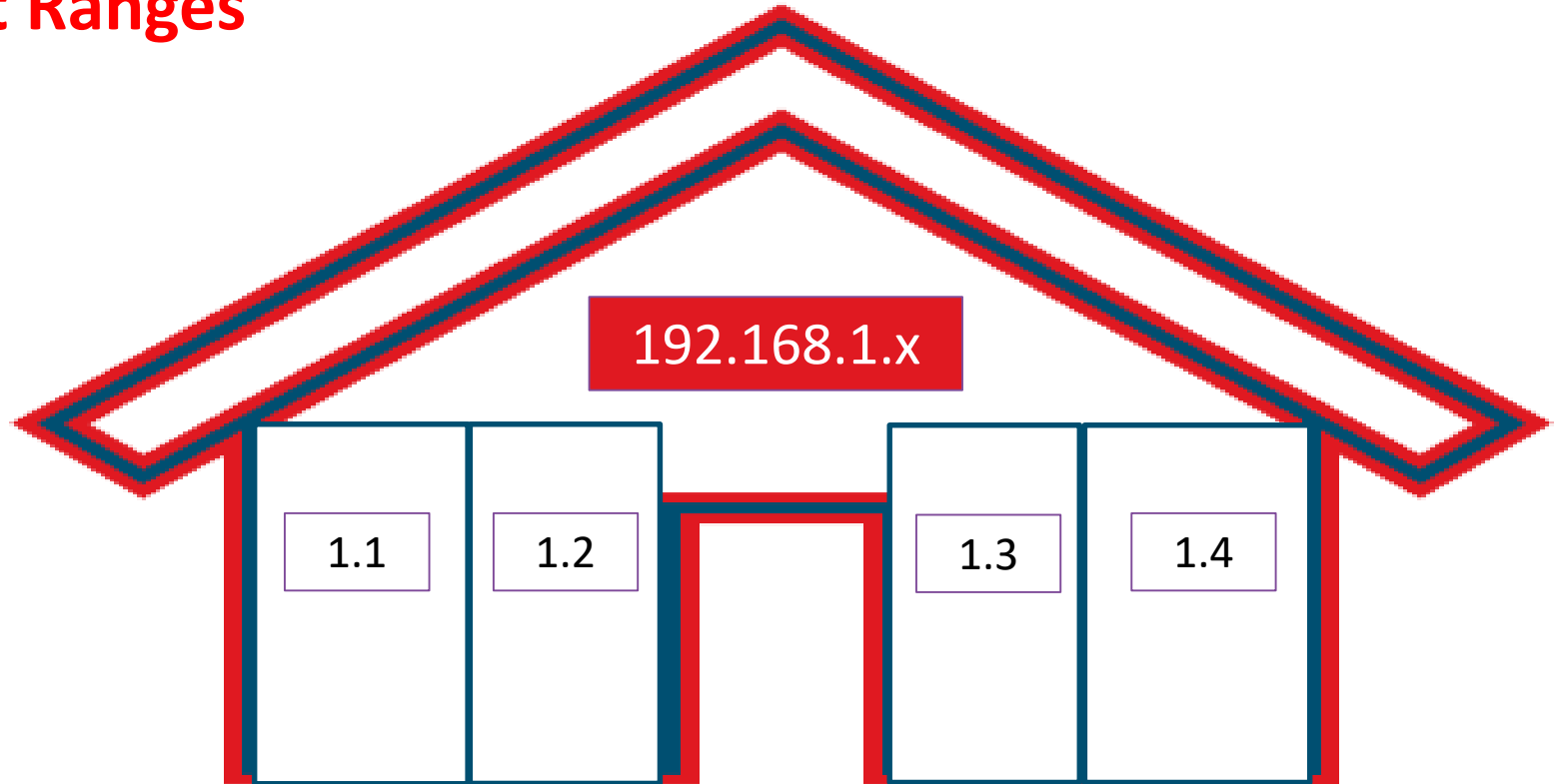
Network: 192.168.1.x

Binary: 11000000.10101000.00000001.00000000

Mask: 255.255.255.0

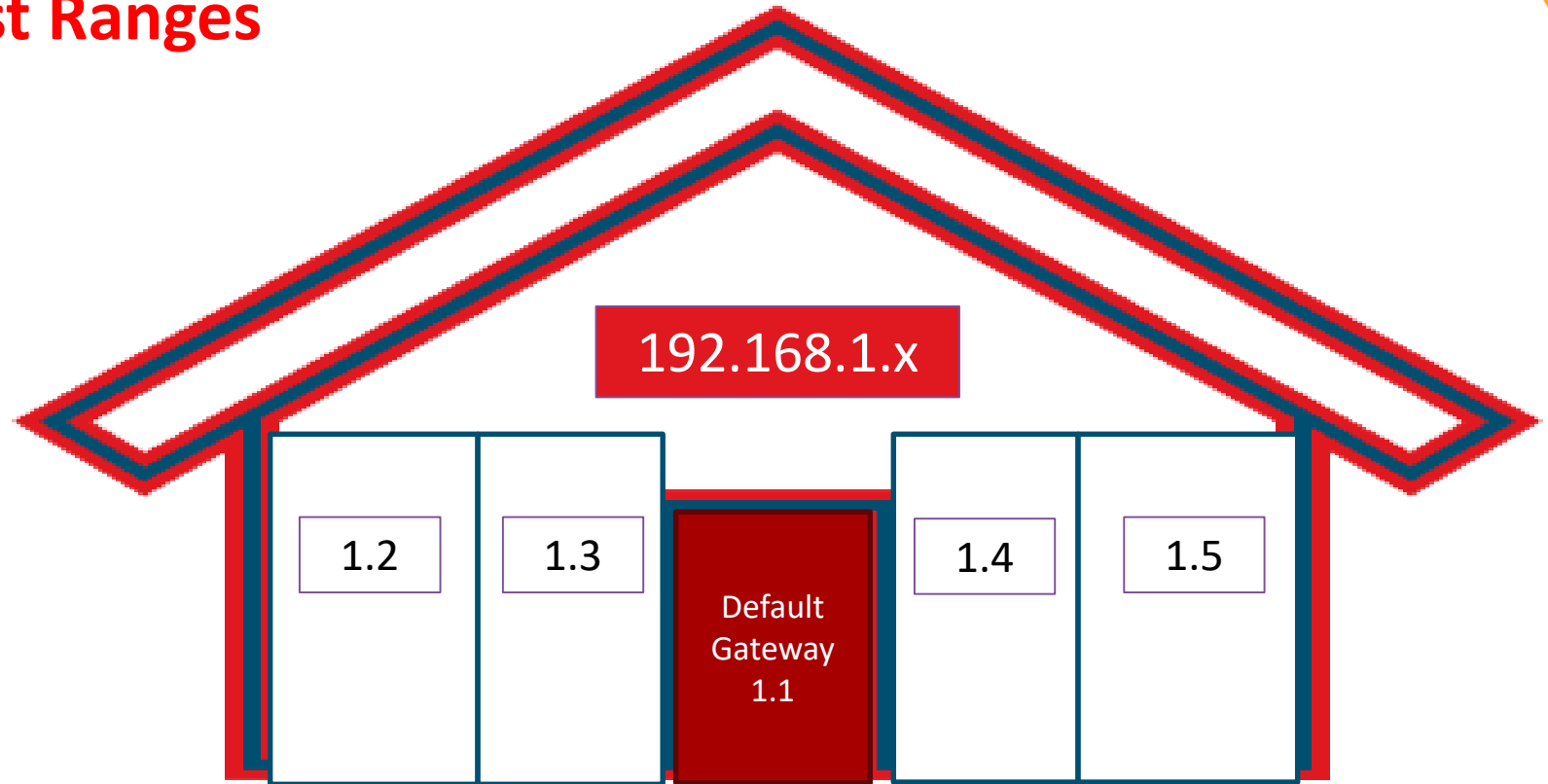
Binary: 11111111.11111111.11111111.00000000

Host Ranges



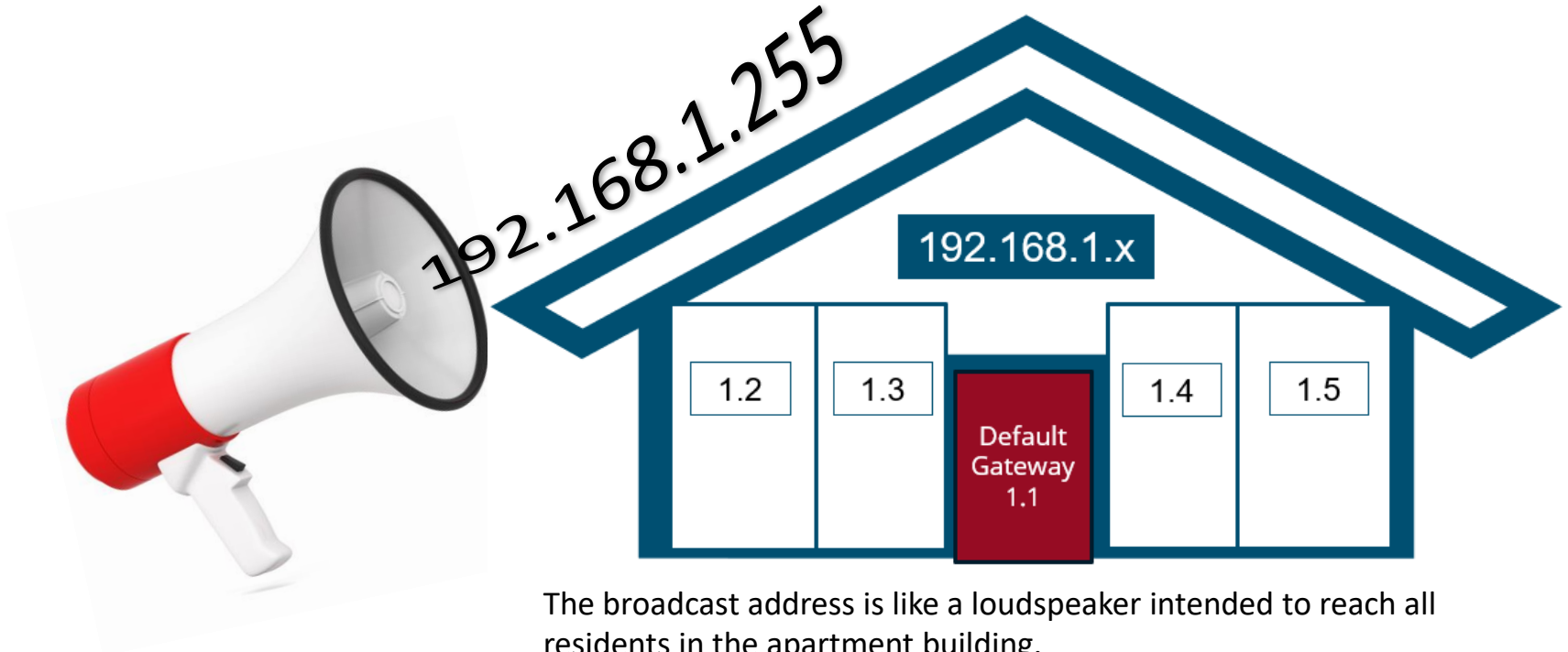
Think of the “network” part of an IP address as the building’s address, and the “host” part as the apartment number.

Host Ranges



The default gateway is like the main entrance of lobby of the apartment building

Broadcast Addresses



The broadcast address is like a loudspeaker intended to reach all residents in the apartment building.

Activity: Fill in the Blanks

IP Address	Subnet Mask	Host Portion	Broadcast Address
192.168.2.123	255.255.255.0	.123	192.168.2.255
10.1.1.9	255.255.0.0	.1.9	10.1.255.255
198.51.100.16	255.255.255.0	.16	198.51.100.255

IP VERSION 4 SUBNETTING



Public vs. Private Addressing

Public IP Addressing

- Assigned by ISPs
- Unique identification on Internet
- Devices requiring direct access to the Internet

Private IP Addressing

- Assigned by private networks
- Unique identification in private network
- Devices not directly accessible from the Internet

Private IP Addresses

Class	Range
A	10.0.0.0 to 10.255.255.255
B	172.16.0.0 to 172.31.255.255
C	192.168.0.0 to 192.168.255.255
D	224.0.0.0 to 239.255.255.255
E	240.0.0.0 to 255.255.255.255

IPv4 Address Scheme Design

When planning a private IPv4 addressing scheme, consider:

- # of IP networks and subnetworks required
- # of hosts per subnet
- Network ID must be from a valid private range
- Network and host IDs cannot be all 1s (broadcast)
- Each host ID must be unique on subnet
- Each network ID must be unique on network



Classful Addressing

Class A	Number of Networks	Number of Hosts per Network	First Octet of Address Range
<div> <div>0???????</div> <div>????????</div> <div>????????</div> <div>????????</div> </div> <div> <div>Network ID</div> <div>Host ID</div> </div>	126	16,777,214	1-126
Class B	Number of Networks	Number of Hosts per Network	First Octet of Address Range
<div> <div>10???????</div> <div>????????</div> <div>????????</div> <div>????????</div> </div> <div> <div>Network ID</div> <div>Host ID</div> </div>	16,384	65,534	128-191
Class C	Number of Networks	Number of Hosts per Network	First Octet of Address Range
<div> <div>110?????</div> <div>????????</div> <div>????????</div> <div>????????</div> </div> <div> <div>Network ID</div> <div>Host ID</div> </div>	2,097,152	254	192-223

Classless Addressing

Borrowing Bits

- Would have represented host information to represent network information
 - Increase available network addresses
 - Reduce usable host addresses in each subnet

Classless Addressing Example

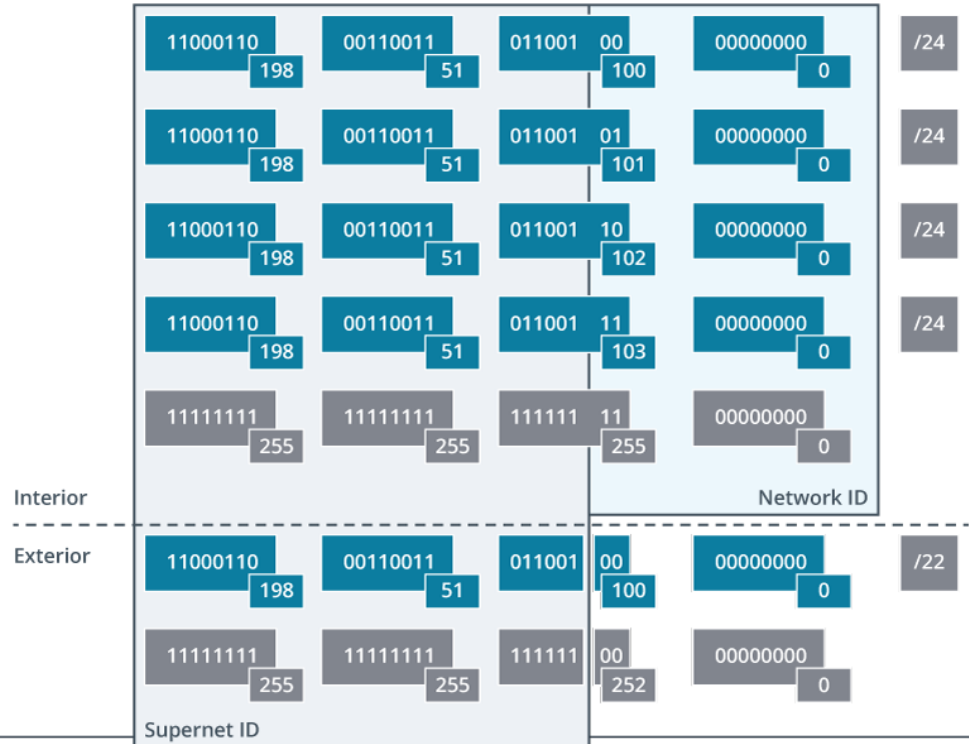
Starting Network ID	192.168.89.0
Starting Subnet mask	255.255.255.0
Starting Network ID in binary	11000000.10101000.01011001.00000000

Borrow one bit from the host to give to the network	11000000.10101000.01011001.00000000
New network ID	192.168.89.128
Range of IP addresses	11000000.10101000.01011001.00000001 through 11000000.10101000.01011001.01111111 192.168.89.1 to 192.168.89.126
New subnet mask	255.255.255.128 or 192.168.89.128/25

Classless Inter-Domain Routing (CIDR)

CIDR

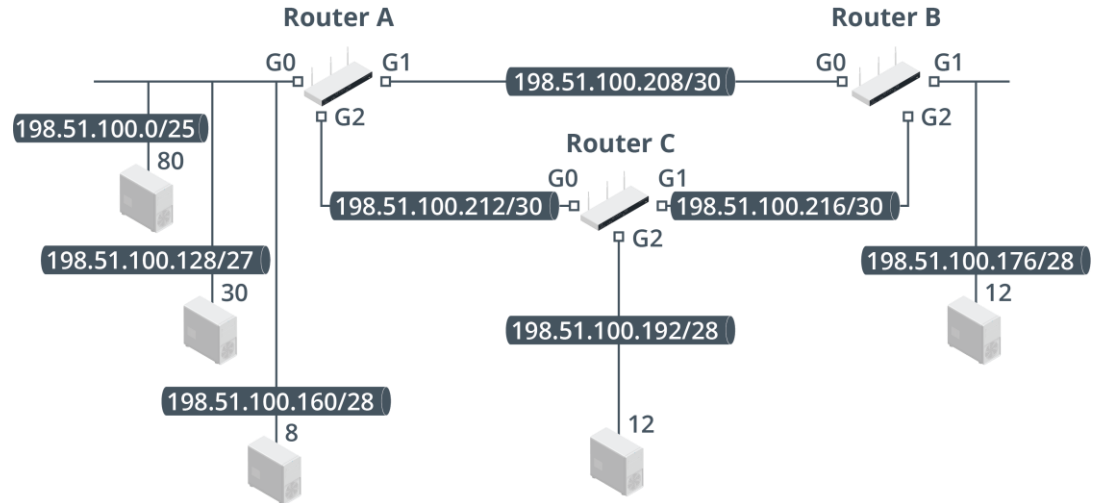
- Allocates IP address space more efficiently
- Combines an IP address with a suffix (network portion of address)
- Allows for variable-length subnetting



Variable Length Subnetting (VLSM)

VLSM

- Creates subnets of different sizes within the same network
- Enables efficient allocation of IP addresses
- Requires careful planning and management



Activity: Classless Addressing

Starting Network ID	192.168.89.0
Starting Subnet mask	255.255.255.0
Starting Network ID in binary	11000000.10101000.01011001.00000000

Borrow two bits from the host to give to the network	11000000.10101000.01011001.00000000
New network ID	192.168.89.192
Range of IP addresses	192.168.89.1 to 192.168.89.62
New subnet mask	255.255.255.192 or 192.168.89.192 /26

LAB TIME | CONFIGURE IP ADDRESSES



IP TROUBLESHOOTING TOOLS



ipconfig

ipconfig

- View IP address, subnet mask, and default gateway for all network interfaces

ipconfig /all

- Also includes complete TCP/IP configuration parameters including DHCP and MAC address

ipconfig /renew

- Renews the client's DHCPs leased IP address

ipconfig /release

- Releases the client's DHCPs leased IP address

Ifconfig and ip

- Reports network interface configuration: **ip addr** (legacy is **ifconfig**)
- Single interface only: **ip addr show dev eth0**
- Status of interfaces: **ip link**
- Enable or disable an interface: **ip link set eth0 up|down**
- Modify the IP address configuration: **ip addr add|delete**



arp

arp -a (or arp -g)

- Shows the ARP cache contents

arp -s *IPAddress MACAddress*

- Adds an entry to the ARP cache

arp -d

- Deletes all entries in the ARP cache

ping

ping

- Tests connectivity with a given IP address
- Format: **ping** *IPaddress*

ping error messaging

- Destination host unreachable
- No reply (request timed out)

IP VERSION 6



IPv6 vs IPv4

Comparison	IP Version 4	IP Version 6
Address format	Dotted decimal format (192.168.1.1)	Hexadecimal format (2001:0db8:85a3:0000:0000:8a2e:0370:7334)
# of addresses	4.3 billion	340 undecillion (3.4×10^{38})
Network and Host Portions	Changes based on subnet mask	First 64 bits are used for network ID. bits are used for host ID

IPv6 Unicast Addressing

Globally scoped unicast addresses are routable over the Internet and are the equivalent of public IPv4 addresses.



IPv6 Multicast and Anycast Addressing

Multicast

- First 8 bits: indicate the address is within the multicast scope
- Next 4 bits: used to flag types of multicast
- Next 4 bits: determine the scope
- Final 112 bits: define multicast groups within that scope

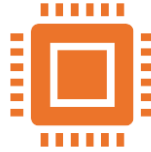
IPv4 and IPv6 Transition Mechanisms



Dual Stack

Allows IPv4 and IPv6 to run simultaneously

Ideal for transitional periods where both IPv4 and IPv6 networks are operational



Tunneling

Encapsulates IPv6 packets within IPv4 packets to traverse IPv4 networks

Useful for IPv6 islands within an IPv4 network



NAT64

Translates IPv6 into IPv4 and vice versa

Best for environments transitioning to IPv6 but still needing access to IPv4 resources

Common IPv6 Address Prefixes

Type	Prefix	Leading Hex Characters
Global unicast	2000::/3	2 3
Link local unicast	fe80::/10	fe80
Multicast	ff00::/8	ff
Multicast (link local)	ff02::/16	ff02::1 (all nodes) ff02::2 (all routers) ff02::1:2 (DHCP)
Solicited-node	ff02::1:ff00:0/104	ff02::1:ff
Unspecified	::/128	0::0
Loopback	::1/128	::1
Documentation/Examples	2001:db8::/32	2001:db8

Discussion

01

What are the differences between IPv4 and IPv6 addressing?

02

Explain how subnetting works and why it is used.

03

What steps would you take to troubleshoot a network with IP-addressing issues?

Summary



IP: Creates interconnected networks (interwork) using unique addresses.



IPv4 Address: 32-bit address divided into four octets.



Network Segment:
Represented by a subnet at layer 3 (Network.)



TCP/IP Utilities: Command-line tools for network configuration and communication monitoring.



IPv6 Address: Eight 16-bit numbers expressed in hexadecimal format.

Discussion time: Please type your questions in chat

- Questions over content.
- Share you experience.
- What would you like to see different moving forward?

Thank You!



Let's keep the conversation going in the CompTIA Instructor Forum: <https://cin.comptia.org>